



**UTILITY APPLICATION**  
**OF**  
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**FOR**  
**UNITED STATES PATENT**  
**ON**  
**ULTRASONIC SLAT WASHER**

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# **ULTRASONIC SLAT WASHER**

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## **BACKGROUND OF THE INVENTION**

### **Field of the Invention**

This invention relates to a washing device, system and method for cleaning slats used in slat-type counting machines adapted for small, discrete particles such as pharmaceutical and nutritional tablets, capsules and caplets.

### **Description of the Related Art**

There are many devices on the market today for counting capsules and tablets into containers such as bottles or boxes. One of the fastest types of tablet counters on the market today is a slat counter wherein slats are fitted onto a moving belt rotating through a hopper containing tablets or capsules. The slats have a predetermined number of holes, each of which are filled with a capsule or tablet from the hopper. As each slat moves to the unloading position, a predetermined number of tablets or capsules are directed into a container.

One type of slat counter is a continuous slat counter, which typically comprises a moving bed with a series of grooved slats that pass beneath a quantity of tablets. The grooves are further subdivided into cavities and one tablet is permitted to drop into each cavity until all the cavities are filled. After the filled slats move from beneath the stationary quantity of tablets, they are inverted and the tablets fall out and are collated

and fed into containers via transport through a manifold system.

Another version of a continuous slat-type counting and filling machine is disclosed in U.S. Patent No. 3,925,960, in which the slats and cavities are oriented horizontally, i.e., coaxial with the axis around which they are moving. A series of  
5 chutes collects the counted tablets and delivers them to a moving series of containers. Yet another variation of slat counting machines is disclosed in U.S. Patent No. 4,674,259, in which the slats are vertically-oriented cavities that deliver the counted product to a series of chutes that shuttle alternately between a first and a second row of containers.

10 While slat-type counting devices provide high speed counting, their advantages become limited when the product enclosed in the capsules changes or when the quantity or size of the capsules to be packaged changes. If any of these parameters are altered, every slat has to be cleaned before it can be re-configured for the new product, which requires considerable down time.

15 The cleaning process presents a number of difficulties due to the size and configuration of typical slats. Historically, the slats used in counting devices are made from a FDA approved material, such as Delrin®, and have a row of cavities drilled into them to hold the tablets or capsules. Therefore, the cleaning process requires the precision of small parts cleaning in that small particles will need to be removed from  
20 small crevice-like openings and indentations. The cleaning process must also be on an industrial scale because the slats are typically fairly large items that must be cleaned in large quantities in industrial packaging settings. Typically, however, slats are taken to

a maintenance area within a manufacturing facility and washed manually with, for example, tap water from a hose, and air-dried. The present invention discloses an apparatus and method for cleaning slats, which permits more thorough and efficient cleaning of slats, which is suited to industrial packaging settings.

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## **SUMMARY OF THE INVENTION**

The present invention generally comprises a housing, support frame, a tub for containing cleaning fluid, a carousal-like fixture assembly, and an ultrasound unit comprising an ultrasonic transducer and sensor, and the slats or other items to be  
10 cleaned. The fixture assembly is mounted onto a rotating shaft disposed inside the housing and is adjustable to accommodate slats or other items of different lengths or sizes. The slats or other items can be loaded one-by-one onto the fixture assembly while the fixture assembly is engaged within the housing, or the fixture assembly can be removed, loaded and placed back in the housing. The fixture assembly is configured to  
15 securely hold the slats in place while cleaning, and preferably rotates 360 degrees for a predetermined amount of time or rotations. Ultrasonic transducers supply energy to clean the slats or other items and are preferably disposed on the bottom of the tub inside the housing. The fixture assembly holds the slats or other items in a secured position, even when energy from the ultrasonic transducer is supplied to the slat washer during  
20 the wash cycle.

During the wash cycle, the tub fills with cleaning liquid, the fixture assembly rotates 360 degrees, and the slats are introduced into and out of the vibrating cleaning liquid for a predetermined amount of time or rotations of the fixture assembly.

The cleaning liquid is then drained from the tub by gravity. During a primary rinse cycle, nozzles disposed in the housing spray pressurized rinse liquid onto the slats, again, for a predetermined amount of time or rotations. During the rinse cycle the gravity drains remain open to remove the water from the bottom of the tub. Once  
5 the cleaning liquid is drained from the primary rinse cycle, an optional purified rinse cycle using United States Pharmacopeia ("USP") water can be performed.

Next, during the drying cycle, the rotating items or slats are dried by nozzles, which emit warm air for a predetermined amount of time or rotations. Once the appropriate wash and dry cycles have been completed, the items or slats can be  
10 removed one-by-one from the enclosure or the entire fixture assembly can be removed with all the items intact and brought directly to the slat counter or other device for re-loading the slats or other items.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

15 Figure 1 is a perspective front view of the slat washer housing and an operating interface panel.

Figure 2 is a perspective of the internal mechanical components of the machine without the housing.

Figure 3 is a perspective of the fixture mounted within the housing.

20 Figure 4 is a perspective of the fixture assembly.

Figure 5 is a perspective of the fixture assembly with slats held intact.

Figure 6 is a perspective of the rinse water system.

Figure 7 is a perspective of the forced warm air system.

Figure 8 is a side perspective of the fixture assembly, with an enlarged view of the slots on the first end disk.

## **DESCRIPTION OF THE PREFERRED EMBODIMENT(S)**

5       The detailed description set forth below in connection with the appended drawings is intended as a description of presently-preferred embodiments of the invention and is not intended to represent the only forms in which the present invention may be constructed and/or utilized. The description sets forth the functions and the sequence of steps for constructing and operating the invention in connection with the  
10   illustrated embodiments. However, it is to be understood that the same or equivalent functions and sequences may be accomplished by different embodiments that are also intended to be encompassed within the spirit and scope of the invention. References herein to right/left, upper/lower, first/second and the like are intended for clarification and are relative and interchangeable.

15       Referring now to the drawings, and in particular, to FIG. 1, the slat washer according to the present invention is generally referred to by reference numeral 10. The ultrasonic slat washer 10 comprises a housing 12 with an access port 14 of predetermined size, preferably disposed on a down-sloping side 16 of the housing top or cover 18 for easy access by the operator. The access port 14 preferably comprises a  
20   lid 66 with a handle 68 projecting upwardly from the lid 66. The housing 12 may be supported on four support feet 20, or on wheels (not shown) for mobility. The housing cover 18 comprises an air inlet 22 to permit movement of warm air used for drying the slats within the housing 12. The housing 12 may comprise durable panels 26, such as

stainless steel panels, that engage with a support frame 28 (FIG. 2) to define the housing.

A tub 30 is configured to fit within the housing 12. The tub 30 is preferably configured with rounded or octagonal walls and may be secured within the housing 12 by outward extending flanges 32a, 32b, tabs 34, or a combination thereof (as shown in FIG. 2), which seat the tub 30 against a stable portion of the housing 12, or preferably against upper elements 36a, 36b of the support frame 28. The tub 30 can be securely affixed to the housing 12 or support frame 28 using conventional means known in the art, such as bolts, screws or weld points. In the preferred embodiment, the tub 30 has rounded sides and an open top and is formed of stainless steel. An ultrasound unit 38, comprising an ultrasound transducer and sensor, preferably engages the bottom 40 of the tub 30. An engagement means 66 secures the ultrasound unit 38 to the support frame 28, tub 30, or housing 12. The ultrasound unit 38 is connected by a cable (not shown) to an electronic power means (not shown) for supplying power to the ultrasound unit 38. The engagement means 66 may comprise tabs or metal flanges that are bolted or welded to the support frame 28, housing 12 or tub 30 to secure the ultrasound unit to the slat washer 10. Alternately, the ultrasound unit 38 may be attained to the slat washer 10 using suitable means known in the art, such as welding, adhesives, bolts or brackets.

In the preferred embodiment, forced air nozzles 68 are linearly arranged along an airflow assembly 70 that is disposed above the upper surface of a fixture assembly 42, and may be releasably secured to the tub 30, support frame 28 or housing 12. The

slat washer 10 may also be configured to operate without an airflow assembly or forced air nozzles. A rinse water unit 72 is preferably disposed inside the tub 30, adjacent its lower end 40 and is preferably configured to be spaced from the lower end of the fixture assembly 42 when it is correctly seated in the tub 30.

5        With reference to FIGS. 3-5 and FIG. 8, the fixture assembly 42 is preferably cylindrical in overall shape and comprises a first and a second end disk 44a, 44b spaced apart by a shaft 46. The end disks 44a, 44b comprise a plurality of slots 48 along their respective perimeters 50a, 50b. The slots 46 on the first end disk 44a preferably align with slots 48 on the second end disk 44b when the end disks 44 are properly seated on  
10    the shaft 46. The slots 46 are configured to receive the distal ends 90 of individual slats 6 therein to secure the slats 6 on the fixture assembly 42.

      In the preferred embodiment, the slots 48 on the first end disk 44a comprise an open side 4 and the slots 48 on the second end disk 44b comprise four closed sides 94. In the preferred embodiment, the slots 48 are angled from a center axis 8 of each  
15    respective end disk 44 so that the slats 6 can be securely seated on the fixture assembly 42 and will remain securely held, even when subject to vibrations from the ultrasound unit 38. In the preferred embodiment, the slots 48 are disposed at an approximately 30 to 60 degree angle from the center axis 8 of the respective end disk 44. Preferably, the  
20    slats 6 are loaded onto the fixture assembly 42 by slipping one slot end 90b in the slots 48b of the second end disk 44b and an opposite slot ends 90a into the open side 4 of the slots 48a on the first end disk 44a. The open side 4 of each slot 48a on the first end disk 44a comprises a tab or hook element 2 (FIG. 8) to assist in securing each slat 6 on

the fixture assembly 42, even when the ultrasound unit 38 is in operation or when the fixture assembly 42 rotates.

In the preferred embodiment, the hook element 2 comprises a substantially rectangular shape that approximates the dimensions of the slot 48 and comprises a top 76, a bottom section 78, two flat sides 80a, 80b, a front side 82a and a rear side 82b. The hook element 2, however, may be of other suitable shapes and dimensions. In the preferred embodiment, the top 76 of the hook element 2 is angled slightly towards either the right or left. A center indentation 86 in the hook element 2 defines a tab 84 adjacent the top 76 of the hook element 2 and the bottom section 78 of the hook element 2. In the preferred embodiment, the hook element 2 is adjustably attached at one of the closed sides 94 of the open-ended slots 48. The hook element 2, however, may also be fixed to the end disk 44 or placed in other suitable locations in relation to the slots 48. Alternately, the slats 6 may be seated on the fixture assembly without the use of the hook element 2.

In the preferred embodiment, one end 90a of an individual slat 6 is seated on one of the end disks 44a and the opposite end 90b of the slat 6 is adjustably but securely seated in a slot 48 on the opposite end disk 44b by fitting the end 90b of the slat 6 in the center indentation 82 disposed in the hook element 2. In the preferred embodiment, the closed and open slot 48 arrangement and hook element 2 provides adjustable and secure placement of different size slats 6 onto the fixture assembly 42 for cleaning in the slat washer 10. The fixture assembly 42, however, may also comprise end disks 44 having alternate slot arrangements, such as all closed or open slots, on each end disk

44. Alternately, each end disk 44 may comprise a combination of open-ended and closed slots 48 so that aligned slots 48 on opposite end disks 44a, 44b comprise one closed end slot and one open-end slot. For example, open and closed slots 48 may alternate on each end disk 44.

5 In the preferred embodiment, one or both of the end disks 44a, 44b slidably engage the shaft 46 to accommodate different length slots 2 or other items. Alternately, one or both end disks 44a, 44b may be fixed to the shaft 46. The shaft 46 preferably has flat sides 52, but may also have rounded sides. In the preferred embodiment, the shaft 46 comprises four flat sides that are approximately three inches in width each, and  
10 engages the end disk 44 by way of a recess block 56 that may be disposed on the inside face 58 of at least one of the end disks 44 or may be disposed in an opening in the end disk 44 to interface with the front and back face of the end disk 44. One or both ends of the shaft 54a, 54b may sit in respective recess blocks 56 or similar structures, may protrude through the recess block 56, or they may fit through an opening in the disk 44  
15 (not shown) to an outside face 60 of the end disk 44. In an alternate embodiment, an opposite end of the shaft 54b may engage the opposite end disk 44b by way of a brace assembly 96 (FIG. 8). Alternately, the opposite end of the shaft 54b may engage the end disk 44b by other suitable means known in the art, such as welding, bolts brackets or adhesives.

20 In the preferred embodiment, at least one, and preferably a pair of seating elements 62 engages the outside face 60 of the disk 44 and one of the shaft ends 54 so

that the fixture assembly 42 rotatably engages with a complementary receiving element 64 disposed on the tub 30 or on the housing 12.

The fixture assembly 42, when seated in the tub 30 or housing 12, is configured so that there is a space between the walls 68 of the tub 30 and the fixture assembly 42 to permit rotation of the fixture assembly 42, even when loaded with slats 2 or other items to be cleaned. When the fixture assembly 42 is removed from the housing 12 to load slats, the seating elements 62 may be fit onto the complementary receiving element 64 disposed on the housing 12 or tub 30 to seat the loaded fixture assembly 42 in the housing 12. Alternately, the fixture assembly 42 may be first seated into place in the housing 12 and the slats 2 or other items loaded one-by-one by rotating the fixture assembly 42 as more slats 2 are loaded. Once the operator has loaded the desired number of slats 2, the access port lid 66 or the housing cover 18 is closed and the unit is powered, preferably by actuating a power switch 76 on a control interface panel 78. The ultrasound unit 38, once powered, imparts ultrasound energy to cleaning liquid in the tub 30, and the fixture assembly 42 preferably rotates the slats 2 in the energized cleaning liquid. The slat washer 10 is preferably powered using 240 VAC, 3 phase power source, but may be powered by other suitable power sources. The slat washer 10 may be manually run, or can be configured to automatically rinse the slats 2 with an optional second rinse cycle using a sterile or purified liquid, such as USP water. In the preferred embodiment, cleaning liquid from wash and rinse cycles drains by gravity. The slat washer 10 may, however, include other suitable types of draining systems known in the art. The slat washer 10 may also include a drainage system comprising

ball valves (not shown). The slats 2 may then be dried during a drying cycle. In the preferred embodiment, forced warm air is blown over the slats 2 from the warm air nozzles 68, while the fixture assembly 42 rotates. The forced air may be supplied to the slat washer by way of dryers that are disposed within an optional cabinet in the slat washer (not shown). The operator may then remove the cleaned and dried slats 2 or other items by opening the access port lid 66 or housing cover 18 and by singly removing each slat 2, or by removing the entire fixture assembly 42 from the slat washer 10. The invention allows the slats 2 or other items to be placed into, cleaned and withdrawn from the slat washer 10, without having to touch the cleaning solution.

While the present invention has been described with regards to particular embodiments, it is recognized that additional variations of the present invention may be devised without departing from the inventive concept.